

WHAT IS CLAIMED IS:

1 1. A system for sending low rate data on a packet basis in
2 an 8-VSB standard data packet stream, said system comprising:
3 an 8-VSB signal transmitter capable of transmitting a low rate
4 data packet that comprises data bytes that contain both information
5 bearing bits and non-information bearing bits.

1 2. The system for sending low rate data on a packet basis in
2 an 8-VSB standard data packet stream as claimed in Claim 1 wherein
3 said 8-VSB signal transmitter is capable of determining the values
4 of said non-information bearing bits in said low rate data packet
5 so that said non-information bearing bits will be correctly
6 encoded.

1 3. The system for sending low rate data on a packet basis in
2 an 8-VSB standard data packet stream as claimed in Claim 1 wherein
3 said low rate data packet comprises data bytes in which half of the
4 bits in each data byte contain information and half of the bits in
5 each data byte do not contain information.

1 4. The system for sending low rate data on a packet basis in
2 an 8-VSB standard data packet stream as claimed in Claim 3 wherein
3 said 8-VSB signal transmitter is capable of determining the values
4 of said bits that do not contain information so that said bits that
5 do not contain information will be correctly encoded.

1 5. The system for sending low rate data on a packet basis in
2 an 8-VSB standard data packet stream as claimed in Claim 3 wherein
3 said low rate data packet comprises eight (8) bit data bytes in
4 which bit 6, bit 4, bit 2, and bit 0 in each data byte contain
5 information and in which bit 7, bit 5, bit 3, and bit 1 in each
6 data byte do not contain information.

1 6. The system for sending low rate data on a packet basis in
2 an 8-VSB standard data packet stream as claimed in Claim 5 wherein
3 said 8-VSB signal transmitter is capable of determining the values
4 of bit 7, bit 5, bit 3, and bit 1 so that they will be correctly
5 encoded.

1 7. The system for sending low rate data on a packet basis in
2 an 8-VSB standard data packet stream as claimed in Claim 6 wherein
3 said 8-VSB signal transmitter determines the values of bit 7, bit
4 5, bit 3, and bit 1 so that each output symbol is from one of the
5 four levels -7, -3, + 3, and +7 by setting the value of the Z_2 bit
6 from a trellis encoder of said 8-VSB signal transmitter equal to
7 the value of the Z_0 bit from said trellis encoder.

1 8. The system for sending low rate data on a packet basis in
2 an 8-VSB standard data packet stream as claimed in Claim 7 wherein
3 said 8-VSB signal transmitter determines the values of bit 7, bit
4 5, bit 3, and bit 1 by calculating the values of bit 7, bit 5, bit
5 3, and bit 1 from the expression:

6 $X_2(k) = Z_2(k) \oplus Z_2(k - 12)$

7 where $X_2(k)$ represents the value of a bit before the bit is input
8 to a pre-coder of said trellis encoder, and where Z_2 represents the
9 value of a bit after the bit is output from said trellis encoder,
10 and where k is a time index, and where the operator \oplus signifies a
11 logical exclusive OR operation.

1 9. A system for sending half rate data on a packet basis in
2 an 8-VSB standard data packet stream in an 8-VSB signal transmitter
3 of the type comprising a Reed Solomon encoder, a data interleaver,
4 and a trellis encoder, wherein said system comprises:

5 a first data packet switch before said Reed Solomon encoder
6 capable of determining whether a data packet is a full rate data
7 packet or a half rate data packet, said first data packet switch
8 capable of sending a full rate data packet to said Reed Solomon
9 decoder and capable of sending a half rate data packet to said data
10 interleaver; and

11 a second data packet switch after said trellis encoder capable
12 of determining whether a data packet is a full rate data packet or
13 a half rate data packet, said second data packet switch capable of
14 sending a full rate data packet to a multiplexer and capable of
15 sending a half rate data packet to an exclusive OR unit.

1 10. The system for sending half rate data on a packet basis
2 in an 8-VSB standard data packet stream as claimed in Claim 9
3 wherein said exclusive OR unit is capable of determining the values
4 of bits in a half rate data packet that do not contain information
5 so that said bits that do not contain information will be correctly
6 encoded.

1 11. The system for sending half rate data on a packet basis
2 in an 8-VSB standard data packet stream as claimed in Claim 10
3 wherein said half rate data packet comprises eight (8) bit data
4 bytes in which bit 6, bit 4, bit 2, and bit 0 in each data byte
5 contain information and in which bit 7, bit 5, bit 3, and bit 1 in
6 each data byte do not contain information; and

7 wherein said exclusive OR unit is capable of determining the
8 values of bit 7, bit 5, bit 3, and bit 1 so that each output symbol
9 is from one of the four levels -7, -3, +3, and +7 by setting the
10 value of the Z_2 bit from said trellis encoder equal to the value of
11 the Z_0 bit from said trellis encoder.

1 12. The system for sending half rate data on a packet basis
2 in an 8-VSB standard data packet stream as claimed in Claim 11
3 wherein said exclusive OR unit is capable of determining the values
4 of bit 7, bit 5, bit 3, and bit 1 by calculating the values of
5 bit 7, bit 5, bit 3, and bit 1 from the expression:

6 $X_2(k) = Z_2(k) \oplus Z_2(k - 12)$

7 where $X_2(k)$ represents the value of a bit before the bit is input
8 to a pre-coder of said trellis encoder, and where Z_2 represents the
9 value of a bit after the bit is output from said trellis encoder,
10 and where k is a time index, and where the operator \oplus signifies a
11 logical exclusive OR operation.

1 13. The system for sending half rate data on a packet basis
2 in an 8-VSB standard data packet stream as claimed in Claim 12
3 wherein an output of said exclusive OR unit is coupled to an input
4 of said Reed Solomon encoder; and wherein said exclusive OR unit is
5 capable of sending a half rate data packet to said Reed Solomon
6 encoder in which the values of bit 7, bit 5, bit 3, and bit 1 in
7 each data byte of said half rate data packet have been determined
8 so that all eight (8) bits in each data byte of said half rate data
9 packet will be correctly encoded.

1 14. The system for sending half rate data on a packet basis
2 in an 8-VSB standard data packet stream as claimed in Claim 13
3 further comprising:

4 a permutation unit located after said Reed Solomon encoder and
5 before said data interleaver, said permutation unit capable of
6 determining whether a data packet is a full rate data packet or a
7 half rate data packet, said permutation unit capable of sending a
8 full rate data packet to said data interleaver without performing
9 a permutation, said permutation unit capable of permuting the bytes
10 in a half rate data packet to ensure that parity byte positions do
11 not occur before the data byte positions in each data packet.

1 15. The system for sending half rate data on a packet basis
2 in an 8-VSB standard data packet stream as claimed in Claim 14
3 wherein said permutation unit is capable of setting a rate bit in
4 a field sync segment of said half rate data packet to change the
5 status of said half rate data packet from half rate status to full
6 rate status.

1 16. The system for sending half rate data on a packet basis
2 in an 8-VSB standard data packet stream as claimed in Claim 15
3 further comprising an 8-VSB signal receiver comprising:

4 a reverse permutation unit located between a data de-
5 interleaver and a Reed Solomon decoder, said reverse permutation
6 unit capable of reversing the permutation of bytes carried out by
7 said permutation unit of said 8-VSB signal transmitter.

1 17. A method for sending low rate data on a packet basis in
2 an 8-VSB standard data packet stream, said method comprising the
3 steps of:

4 placing data in a low rate data packet that comprises data
5 bytes that contain both information bearing bits and non-
6 information bearing bits;

7 determining the values of said non-information bearing bits in
8 said low rate data packet so that said non-information bearing bits
9 will be correctly encoded; and

10 transmitting said low rate data packet with an 8-VSB signal
11 transmitter.

1 18. The method for sending low rate data on a packet basis in
2 an 8-VSB standard data packet stream as claimed in Claim 17 wherein
3 said low rate data packet comprises data bytes in which half of the
4 bits in each data byte contain information and half of the bits in
5 each data byte do not contain information.

1 19. The method for sending low rate data on a packet basis in
2 an 8-VSB standard data packet stream as claimed in Claim 17 wherein
3 the step of placing data in a low rate data packet that comprises
4 data bytes that contain both information bearing bits and non-
5 information bearing bits comprises the steps of:

6 placing data in bit 6, bit 4, bit 2, and bit 0 in each eight
7 (8) bit data byte so that bit 6, bit 4, bit 2, and bit 0 are
8 information bearing bits; and

9 placing no data in bit 7, bit 5, bit 3, and bit 1 in each
10 eight (8) bit data byte so that bit 7, bit 5, bit 3, and bit 1 are
11 non-information bearing bits.

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1 20. The method for sending low rate data on a packet basis in
2 an 8-VSB standard data packet stream as claimed in Claim 19 wherein
3 the step of determining the values of said non-information bearing
4 bits in said low rate data packet so that said non-information
5 bearing bits will be correctly encoded comprises the step of:

6 setting the value of the Z_2 bit from a trellis encoder of said
7 8-VSB signal transmitter equal to the value of the Z_0 bit from said
8 trellis encoder so that each output symbol is from one of four
9 levels -7, -3, +3, and +7; and

10 calculating the values of bit 7, bit 5, bit 3, and bit 1 from
11 the expression:

12 $X_2(k) = Z_2(k) \oplus Z_2(k - 12)$

13 where $X_2(k)$ represents the value of a bit before the bit is input
14 to a pre-coder of said trellis encoder, and where Z_2 represents the
15 value of a bit after the bit is output from said trellis encoder,
16 and where k is a time index, and where the operator \oplus signifies a
17 logical exclusive OR operation.

1 21. The method for sending low rate data on a packet basis in
2 an 8-VSB standard data packet stream as claimed in Claim 20 further
3 comprising the steps of:

4 permuting the bytes in said low rate data packet to ensure
5 that parity byte positions of said low rate data packet do not
6 occur before the data byte positions in each low rate data packet;
7 and

8 reverse permuting said permuted bytes in said low rate data
9 packet after said low rate data packets are received in an 8-VSB
10 signal receiver.

1 22. The method for sending low rate data on a packet basis in
2 an 8-VSB standard data packet stream as claimed in Claim 19 further
3 comprising the steps of:

4 sending said low rate data packet through a data interleaver;
5 sending said low rate data packet through a trellis encoder;
6 sending said low rate data packet through an exclusive OR
7 unit;

8 sending said low rate data packet through a Reed Solomon
9 encoder;

10 sending said low rate data packet through a permutation unit;
11 sending said low rate data packet through said data
12 interleaver a second time; and

13 sending said low rate data packet through said trellis encoder
14 a second time.

1 23. A high definition television system comprising a system
2 for sending low rate data on a packet basis in an 8-VSB standard
3 data packet stream, said system comprising:

4 an 8-VSB signal transmitter capable of transmitting a low rate
5 data packet that comprises data bytes that contain both information
6 bearing bits and non-information bearing bits.

1 24. The high definition television system as claimed in Claim
2 23 wherein said 8-VSB signal transmitter is capable of determining
3 the values of said non-information bearing bits in said low rate
4 data packet so that said non-information bearing bits will be
5 correctly encoded.

1 25. The high definition television system as claimed in Claim
2 23 wherein said low rate data packet comprises eight (8) bit data
3 bytes in which bit 6, bit 4, bit 2, and bit 0 in each data byte
4 contain information and in which bit 7, bit 5, bit 3, and bit 1 in
5 each data byte do not contain information; and wherein said 8-VSB
6 signal transmitter is capable of determining the values of bit 7,
7 bit 5, bit 3, and bit 1 so that they will be correctly encoded.

1 26. The high definition television system as claimed in Claim
2 25 wherein said 8-VSB signal transmitter determines the values of
3 bit 7, bit 5, bit 3, and bit 1 so that each output symbol is from
4 one of the four levels -7, -3, + 3, and +7 by setting the value of
5 the Z_2 bit from a trellis encoder of said 8-VSB signal transmitter
6 equal to the value of the Z_0 bit from said trellis encoder.

1 27. The high definition television system as claimed in Claim
2 26 wherein said 8-VSB signal transmitter determines the values of
3 bit 7, bit 5, bit 3, and bit 1 by calculating the values of bit 7,
4 bit 5, bit 3, and bit 1 from the expression:

5 $X_2(k) = Z_2(k) \oplus Z_2(k - 12)$

6 where $X_2(k)$ represents the value of a bit before the bit is input
7 to a pre-coder of said trellis encoder, and where Z_2 represents the
8 value of a bit after the bit is output from said trellis encoder,
9 and where k is a time index, and where the operator \oplus signifies a
10 logical exclusive OR operation.

1 28. The high definition television system as claimed in Claim
2 27 further comprising:

3 a permutation unit located after a Reed Solomon encoder and
4 before a data interleaver in said 8-VSB signal transmitter, said
5 permutation unit capable of permuting the bytes in a half rate data
6 packet to ensure that parity byte positions do not occur before the
7 data byte positions in each data packet.

1 29. The high definition television system as claimed in Claim
2 28 further comprising:

3 an 8-VSB signal receiver comprising a reverse permutation unit
4 located between a data de-interleaver and a Reed Solomon decoder of
5 said 8-VSB signal receiver, said reverse permutation unit capable
6 of reversing the permutation of bytes carried out by said
7 permutation unit of said 8-VSB signal transmitter.